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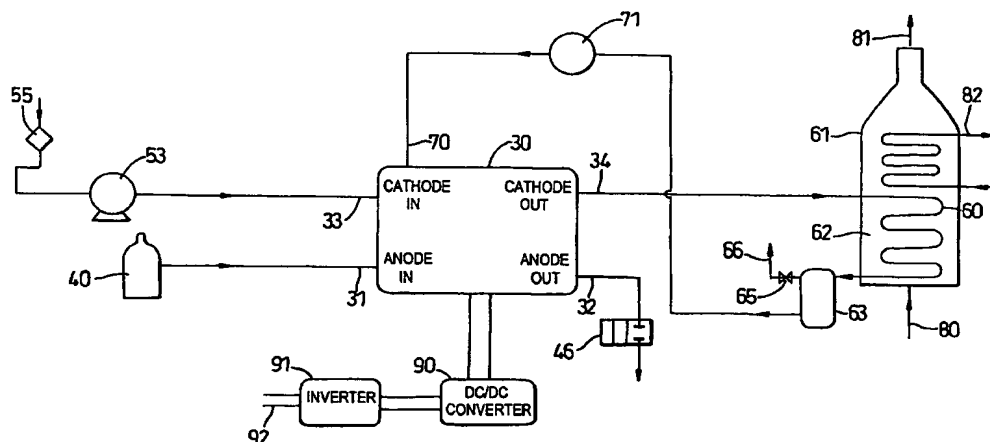
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(54) Title: THERMAL ENERGY MANAGEMENT IN ELECTROCHEMICAL FUEL CELLS



(57) Abstract: A fuel cell assembly supplies water and water vapour by-product to a cooling water circuit delivered to a thermal storage tank from which it can be recycled to the fuel cell stack as direct input to the membrane electrode assemblies, for use as fuel/oxidant preheat and/or direct water injection to the membrane electrode assembly. The purity of water delivered to the membrane is thereby assured. The thermal storage tank allows for a decoupling of the thermal and electrical loads on the fuel cell stack in a combined heat and electrical power delivery unit. Under low external electrical loads, the fuel cell stack and its cooling circuit may be used at high capacity to provide hot water.

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**(15) Information about Correction:**

**Previous Correction:**

see PCT Gazette No. 34/2004 of 19 August 2004, Section II

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 03/05057

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H01M8/02 H01M8/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 07, 3 July 2002 (2002-07-03) & JP 2002 075427 A (TOYOTA INDUSTRIES CORP), 15 March 2002 (2002-03-15) abstract	1,3,4,9, 13,15
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 04, 31 August 2000 (2000-08-31) & JP 2000 018718 A (MITSUBISHI ELECTRIC CORP), 18 January 2000 (2000-01-18) abstract	1,4-6,9, 13,15,16
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 03/05057

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 05; 3 May 2002 (2002-05-03) & JP 2002 008690 A (KURITA WATER IND LTD), 11 January 2002 (2002-01-11) abstract; figure 1 -----	1, 4, 13, 15
A	PATENT ABSTRACTS OF JAPAN vol. 009, no. 280 (E-356), 8 November 1985 (1985-11-08) & JP 60 124366 A (KOGYO GIJUTSUIN; others: OJ), 3 July 1985 (1985-07-03) abstract; figure 1 -----	
A	EP 1 056 148 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 29 November 2000 (2000-11-29) abstract; figure 1 -----	

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB 03/05057

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 20, 21  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

Continuation of Box I.2

Claims Nos.: 20, 21

Claims 20 and 21 refer to the drawings in a vague way, which renders the intended scope of the claim unclear (Art. 6 PCT).

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 03/05057

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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